McKinsey Global Institute

Executive summary

The future of women at work

Transitions in the age of automation

June 2019

McKinsey Global Institute

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The future of women at work: Transitions in the age of automation

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In brief

The future of women at work: Transitions in the age of automation

In the automation age, women face new challenges overlaid on long-established ones. Technology adoption could displace millions from their jobs; many others will need to change the way they work. Globally, 40 million to 160 million women may need to transition between occupations by 2030, often into higher-skilled roles. If they make these transitions, women could find more productive, better paid work; if they don't, they could face a growing wage gap or leaving the labor market. Men and women need to be skilled, mobile, and tech-savvy in the automation age, but women face pervasive barriers. Concerted and creative new solutions are needed to enable women to move forward.

- Men and women tend to cluster in different occupations in both mature and emerging economies, and this shapes how each is likely to be affected by automation. For instance, in many countries, women account for more than 70 percent of workers in healthcare and social assistance, but less than 25 percent of machine operators and craft workers.

- In a scenario where automation unfolds on the scale of past technological disruptions, women and men could face job displacement and potential job gains of a broadly similar magnitude. In the ten countries studied, an average of 20 percent of working women (107 million) could lose their jobs to automation versus 21 percent of men (163 million) by 2030. Rising demand for labor could imply 20 percent more jobs for women, compared with 19 percent for men, assuming their shares of sectors and occupations hold. Entirely new occupations will also be created, but approximately 60 percent of new US occupations have been in male-dominated fields.

- However, the composition of potential job losses and gains for men and women could be different. Service-oriented and clerical support occupations could account for 52 percent of women's job losses, but machine operation and craft work occupations could account for 40 percent of men's losses. Women are well represented in fast-growing healthcare, which could account for 25 percent of potential jobs gained for women, while manufacturing could account for 25 percent of jobs gained for men.

- Worldwide, 40 million to 160 million women—7 to 24 percent of those currently employed—may need to transition across occupations (the wide range reflects different paces of automation). For men, the range is comparable at 8 to 28 percent. If women take advantage of transition opportunities, they could maintain their current share of employment; if they cannot, gender inequality in work could worsen.

- To make these transitions, women will need new skills. In mature economies, only jobs requiring a college or advanced degree may experience net growth in demand. In emerging economies, the many women working in subsistence agriculture with little education may have difficulty securing work in other sectors. Even women remaining in their current jobs will need to refresh their skills; they could be more prone than men to partial automation of their jobs, and will need to learn to work alongside automated systems.

- More women work in lower-paid occupations than men. In mature economies, demand for high-wage labor is expected to grow, while demand for medium- and low-wage labor could shrink. Many emerging economies could experience stronger growth in demand for higher-wage jobs. Enabling women to move up the skills ladder could prepare them for higher-paying jobs and more economic opportunity. However, a potential glut of workers in lower-wage jobs—including men displaced from manufacturing—could put pressure on wages. Some women could leave the labor market entirely.

- Long-established barriers will make it harder for women to make transitions. They have less time to reskill or search for employment because they spend much more time than men on unpaid care work; are less mobile due to physical safety, infrastructure, and legal challenges; and have lower access to digital technology and participation in STEM fields than men. Policy makers and businesses need to step up interventions, some targeted at women, to overcome these barriers. High priorities include more investment in training and transitional support; more provision of childcare and safe and affordable transportation; addressing stereotypes about occupations; boosting women's access to mobile internet and digital skills in emerging economies; and supporting women in STEM professions and entrepreneurship.

The future of women at work

Navigating transitions could put women on a path to more productive, better-paid work; failing to do so could worsen existing challenges

The overall scale of job losses and gains could be similar for men and women[1]

Patterns of jobs lost and gained could differ for men and women

Biggest **job losses** (% of 2017 employment for each gender)

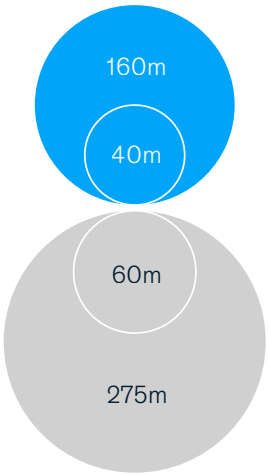
- Service workers **30%**
- Machine operators and craft workers **40%**

Biggest **job gains** (% of 2017 employment for each gender)

- Healthcare sector **25%**
- Manufacturing sector **25%**

To capture job opportunities, millions of women could need to make major work transitions by 2030

40 million–160 million women (7–24%) and 60 million–275 million men (8–28%) could need to switch occupations by 2030. If women can navigate these transitions, they could maintain their current share of employment; otherwise gender inequality in work could worsen.



Many women may need higher education attainment or reskilling to stay employed.

Mature markets

College/advanced degree
More

Associate
Less

Secondary education
Significantly less

Lower than secondary education
Less

Emerging markets

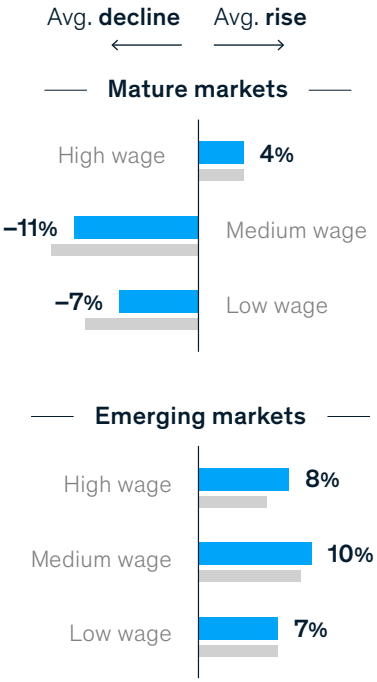
College/advanced degree
More

Associate
More

Secondary education
Significantly more

Lower than secondary education
Flat/similar

Navigating the transitions holds the promise of higher wages for women.



Concerted measures and creative new solutions by governments, companies, and individuals are needed in three areas to enable the necessary transitions and overcome long-established barriers

1. Invest in training programs and platforms to enable women to develop necessary skills.
2. Enable women to balance unpaid and paid work, and develop infrastructure and networks, to boost their labor mobility.
3. Raise women's access to technology, their skills to use it, and their share of tech jobs and leadership roles.

[1] Based on analyzing ten countries that account for about 60% of global GDP: Canada, China, France, Germany, Japan, Mexico, India, South Africa, the United Kingdom, and the United States.

Source: McKinsey Global Institute analysis

NOTE: All numbers described are based upon a trend-line scenario of job creation and a midpoint scenario of automation. The range of transitions estimate is based upon both an early and a midpoint scenario of automation. See technical appendix for more details.

Executive summary

40m–160m

women globally may need to transition between occupations by 2030

The world of work is undergoing a radical transformation as automation—and, on the near horizon, artificial intelligence (AI) technologies—begins to sweep through sectors and businesses search for productivity gains. Automation promises a new productivity revolution as robots and computers take over many routine physical tasks and are increasingly capable of accomplishing work that requires cognitive abilities.

Men and women could experience significant improvements in their working lives, spending less time on repetitive routine tasks such as data processing and physical manual labor, thus freeing up time to use social, emotional, and higher cognitive skills instead. In a partially automated emergency room, for instance, health workers could spend less time on paperwork and more time interacting with patients. Many more women (and men) will work alongside machines and will have more fulfilling and productive working lives as a result.

However, automation will undoubtedly be disruptive for many. This report builds on two bodies of MGI work: automation and the future of work, and the power of parity. In this research, many of our findings apply to men and women, but our focus is seeking to understand how automation could affect women, in particular, and what the future of work could look like for them. Our main findings are at the level of occupations, sectors, and economies, but the impact of automation can even vary within countries at the local level, as our work in the United States shows.[1]

The spread of automation could potentially displace millions of female workers from their current jobs, and many others will need to make radical changes in the way they work. At the same time, shifting population dynamics and growing incomes will drive increased demand for certain jobs. Globally, between 40 million and 160 million women may need to transition between occupations by 2030, often into higher-skilled roles. Navigating these transitions successfully could mean that many women would be well positioned for more productive, better-paid work, allowing them to maintain or even improve on their current share of employment.

However, this positive outcome could be challenging for many women to secure. To make these transitions successfully, women will need different skills and more education, mobility to switch jobs easily, and access to technological capabilities that will not only be in demand, but can also open up new ways of working and new sources of economic opportunity. Women face persistent challenges on these three dimensions that will be needed to thrive in the automation era; these challenges have already slowed women's progress toward gender equality in work.

In 2015, the 193 member nations of the United Nations agreed to the Sustainable Development Goals (SDGs). One of these, goal five, focuses on gender equality. In the four years since, women's progress toward equality in the workplace continues to lag behind societal measures of equality.[2] In 2015, MGI mapped 15 indicators of gender inequality in society (women's education levels and rate of child marriage, for instance) and gender

[1] MGI is publishing research on the future of work in the United States in summer 2019.

[2] A GPS score of zero represents no gender parity, while 1.0 represents full gender parity. For instance, a GPS score of 0.95 indicates that 5 percent further progress is needed before full gender parity is attained. See *The power of parity: How advancing women's equality can add $12 trillion to global growth*, McKinsey Global Institute, September 2015. Since its original 2015 global research, MGI has looked at gender inequality in France and Western Europe, India, the United States, the United Kingdom, Canada, the Netherlands, and Asia Pacific. All reports can be downloaded at **https://www.mckinsey.com/mgi/our-research/productivity-competitiveness-and-growth**.

inequality in work (for example, female labor-force participation, and presence in leadership roles) and compiled them into a gender parity score, or GPS. Since that research in 2015, our score for gender equality in work has risen from 0.51 to 0.52; this score continues to trail our score for gender equality in society, which has risen from 0.66 to 0.67. Now that we are entering the automation era, the future of work for women will overlay new challenges on long-established ones.

Leaders in the private, public, and social sectors will need to be bold, putting in place concerted measures—many of them designed with women specifically in mind—to enable women to develop the skills, the flexibility and mobility, and the tech access and expertise that will be needed. The stakes are high. If women fail to make the necessary transitions, they could face a wider wage gap relative to men or even drop out of the workforce altogether, falling further behind in their share of employment.

MGI has extensively researched the future of work (see Box E1, "Modeling trends in the future of work"). This report builds on that research by looking specifically at the changing world of work for women. We used MGI's future of work models to analyze how women and men could fare in the employment market from now to 2030.[3] We evaluated several scenarios of "jobs lost" (jobs displaced by automation), "jobs gained" (job creation driven by economic growth, investment, demographic changes, and technological innovation), and "net jobs" (combining jobs lost and jobs gained) by 2030. The main scenario described in this report consists of a "midpoint" automation scenario in which the pace at which automation unfolds is on par with the scale of past major technological disruptions, and a "trend-line" scenario of job growth, in which job creation occurs based on current spending and investment trends observed across countries. We also evaluated how jobs may change as their underlying activities evolve due to automation. We assessed how women could be affected differently from men by the future of work by overlaying current female and male employment data on these scenarios, and assuming that the current representation of men and women in occupations and sectors remains unchanged from 2017 to 2030. Using this approach, we tested how well positioned women currently are to react to and benefit from future work trends, given their current occupational and sectoral representation in the labor market.

The research covers six mature economies (Canada, France, Germany, Japan, the United Kingdom, and the United States) and four emerging economies (China, India, Mexico, and South Africa). Together, these ten economies account for about half of the world's population and about 60 percent of global GDP. They have a wide range of demographic profiles, stages of economic development, and degrees of progress toward gender parity, as well as different patterns in how women are likely to be affected by automation and other trends (see Box E2, "Countries exhibit differences and similarities in patterns of women's future work" at the end of this executive summary).

This report is not meant to predict the future; our findings could shift depending on different modeling scenarios for jobs lost and jobs gained, as well as different assumptions of gender mix in sectors and occupations from 2017 to 2030. For instance, in an "early automation scenario" in which certain technologies (for instance, technology replacing predictable physical labor) are adopted more rapidly, the disparity of outcomes between men and women could be larger because the jobs that men typically hold are automated faster. Similarly, if women are able to improve their representation in the economy over time—which they may

[3] MGI's research on the future of work—for men and women—in the automation age found that around half of current work activities are technically automatable by adapting current technologies, that between 15 and 30 percent of workers around the world could potentially be displaced, and that 3 to 14 percent of workers may need to change their occupational category due to automation. MGI's models quantified the potential loss of 400 million jobs in a midpoint automation scenario across 46 countries, but the potential creation of between 500 million and 900 million jobs globally by 2030. Although MGI found that enough jobs could be created to maintain full employment in the period to 2030 in most scenarios, many workers will need to undertake challenging transitions. See *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017; *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, December 2017; and *Skill shift: Automation and the future of the workforce*, McKinsey Global Institute, May 2018.

do, especially in some emerging economies where their representation currently tends to be lower than in developed economies—the future could look brighter for women than in the scenario described in much of this report. That main scenario describes one potential outcome as the result of several trends that affect women, which we hope can be useful as a tool for discussion and decision making. We also use other scenarios at various points in the report to help highlight a range of possible outcomes.

This research breaks new ground, we believe, because it looks at a broad range of effects on women's employment in the future, including potential job displacement, opportunities for job creation, and the changing nature of jobs, and makes a quantitative assessment of the transitions that women will need to make to capture these new opportunities, including implications for wages and average education levels. We note that several important aspects of the discussion on how the future of work may unfold are beyond the scope of this research. Other digital technologies, such as independent work platforms and digital identification, may also have an impact on women's employment, but we do not quantify the effects of these technologies on employment. Nor do we discuss how patterns of the future of work could vary between men and women of different ages, or between part-time and full-time workers. We acknowledge that these aspects are all areas for useful study in the future.

In this report, first we look at how men and women are employed across different sectors and occupations, and then lay out potential scenarios for the world of work in 2030, looking at possible levels of job displacement and job growth in an era of automation. Next, we discuss the prospect of partial automation of women's jobs, and how women's work could change as a result. We explore the transitions millions of women (and men) will need to make across occupations, increasing demand for more educated workers and different skills, and prospects for gender wage disparity in light of a shift to higher-wage employment. Finally, we look at three areas where there is an imperative to address barriers women face—the need for skills development, enhanced mobility, and more access to technology and the capabilities to use it—and discuss the kind of measures that may be necessary to support women as they make transitions in their working lives.

Box E1

Modeling trends in the future of work

MGI's research on the future of work studies the effect on businesses, workers, and the workplace of the growing adoption and diffusion of automation and AI, including an examination of how work activities, occupations, and business processes will change and the shifting skill requirements for the workforce. The research has focused on several key metrics: jobs lost (jobs that will be displaced due to automation), jobs gained (jobs that will be added due to economic growth, investment, and demographic changes), net jobs (the net increase or decrease in jobs based on additions and losses), and jobs changed (jobs that will be altered but not lost as a result of the partial automation of tasks and the broader adoption of technology in the workplace).

In its first report on the future of work, in 2017, MGI found that about half of the activities that people are paid to do could theoretically be automated using currently demonstrated technologies.[1] The research found that less than 5 percent of occupations consisted of activities that could be fully automated, but that at least one-third of activities in 60 percent of occupations could be automated. MGI then estimated the potential extent of automation adoption in several countries using five factors: technical feasibility, the cost of developing and deploying solutions, labor market dynamics, the relative economic benefit of adoption, and the likelihood of regulatory and social acceptance.

In its examination of two scenarios of early and midpoint automation adoption, MGI estimated that between 400 million and 800 million individuals could be displaced by automation by 2030. Of the total workers displaced, up to 375 million may need to switch occupational categories and learn new skills.

Later in 2017, MGI returned to this analysis and looked in detail at jobs lost and jobs gained across occupations and sectors. This analysis covered 46 countries, accounting for almost 90 percent of global GDP, and focused in particular on six countries (China, Germany, India, Japan, Mexico, and the United States). For each, MGI modeled the potential net employment changes for more than 800 occupations based on different scenarios for the pace of automation adoption and for future labor demand. To translate automation adoption rates into jobs lost, MGI assumed that automation adoption rates directly translated into an estimate of jobs lost (for instance, if an occupation was found to have a 5 percent automation adoption rate by 2030, this would translate into 5 percent of jobs within that occupation category being lost). We found that, in a midpoint scenario, 400 million jobs could potentially be lost due to automation in the period to 2030.[2]

At the same time, trends in seven catalysts—rising incomes, healthcare spending due to an aging population, technology adoption, marketization of unpaid work, and spending on infrastructure, construction, and energy—could create between 555 million and 890 million jobs around the world.[3] The lower figure results from a "trend-line" scenario, while

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1 *A future that works: Automation, employment, and productivity,* McKinsey Global Institute, January 2017.

2 We use the term "jobs" as shorthand for full-time equivalent workers (FTEs), and we apply our analysis to both work displaced by automation and new work created by future labor demand. In reality, the number of people working is larger than the number of FTEs, because some people work part time. Our analysis of FTEs covers employees at firms as well as independent contractors and freelancers.

3 *Jobs lost, jobs gained: Workforce transitions in a time of automation,* McKinsey Global Institute, December 2017.

the higher figure is the result of a "step-up" scenario that assumes an additional governmental policy-driven boost to construction and infrastructure, as well as a push to marketize unpaid labor. While there are many scenarios and sources of potential labor demand that we have not included, the seven trends on which we focus in this report have the potential to create demand for hundreds of millions of workers globally through 2030, albeit with significant variations among countries. Our work also accounts for job growth in entirely new occupations; historical analysis suggests that we might expect up to 9 percent of the 2030 employed population in a given country to be employed in such new roles, potentially adding more than 160 million additional jobs.[4]

In 2018, MGI examined the shifts in skills that will be needed to ensure that men and women can remain employed in the automation age. We modeled skill shifts from automation and AI technologies in the period to 2030 and found that they would accelerate. Demand for technological skills has been growing since 2002 but will gather pace. Demand for social and emotional skills will also speed up. However, the need for basic cognitive skills and physical and manual skills will decline.[5]

For this report, we leverage the existing MGI research that we have described and extend it to cover ten countries.[6] We find that more than 300 million net jobs could be added to the global labor market in the ten countries studied by 2030.[7] Substantially more of this growth in jobs is likely to be in emerging economies, with the exception of South Africa. These estimates are based on a midpoint automation scenario and a trend-line scenario for job growth. We then apply a gender lens to identify the differential impact of these trends on men and women. We assume that the current representation of men and women in each sector and occupation remains the same between now and 2030 for two reasons. First, we find (as we detail later) that men and women tend to be concentrated in certain sectors and occupations, and that shifts in sectors and occupations between genders in recent years have been limited. Second, this approach allows us to assess how well positioned men and women are today to capture future job opportunities.

4 Based upon analysis conducted in Jeffrey Lin, "Technological adaptation, cities, and new work," *Review of Economics and Statistics*, May 2011, Volume 93, Number 2.
5 *Skill shift: Automation and the future of the workforce,* McKinsey Global Institute, May 2018.
6 All analyses are based upon MGI future of work models as of April 2019. These models are subject to change as we continue to refine and update underlying data.
7 See *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017; *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, December 2017; and *Skill shift: Automation and the future of the workforce,* McKinsey Global Institute, May 2018.

The future of work will look different for women and men due to entrenched gender differences in occupations and sectors

72%

of clerical support workers, on average, are female in mature economies

Across countries, there are distinct gender differences in employment across occupations and sectors, which shape women's prospects for jobs lost and gained differently from those of men. For instance, in mature economies women account for only 15 percent of machine operators on average.[4] However, women account for 72 percent, on average, of clerical support workers. In emerging economies, women make up 22 percent of machine operators on average, but 43 percent of clerical support workers. We see a similar trend across sectors. More than 70 percent of workers in healthcare and social assistance in nine of the ten countries studied (India is the exception) are women. Conversely, less than 15 percent of construction workers, and only about 30 percent of manufacturing workers, are female in many countries (Exhibits E1 and E2).

To some extent, the concentration of men or women in specific occupations and sectors reflects the degree to which women participate in the labor force, and is not correlated to level of economic development (Exhibit E3). For instance, gender concentration in specific occupations and sectors is more pronounced in India than in other countries studied, reflecting the facts that women's labor-market participation is relatively low and women's jobs are concentrated in agriculture. In countries like China and Canada where labor-force participation is relatively high among women, gender concentration in certain occupations and sectors is less marked. Nevertheless, even in mature economies with high female labor-force participation, gender differences exist within occupations and sectors, suggesting that deep social and cultural norms influence where women (and men) work. It remains unclear to what extent "innate" differences between men and women contribute to choices about the kind of work they do. We do not explore this topic in this report, and we acknowledge that, ultimately, where women and men work is a matter of personal choice that is likely shaped by preference as well as social and environmental factors.

These measures of gender concentration are entrenched and persistent, and they could be difficult to overcome. They matter because where men and women are employed today influences how they will be affected by automation, and this could also be indicative of their ability to tap into future growth opportunities across sectors and occupations.

[4] All average figures cited here refer to simple averages unless otherwise noted.

Women may be at slightly less risk of losing their jobs due to automation than men

~52%

of female jobs lost could be in clerical support and service worker roles

Despite lower shares in automation-prone manufacturing occupations, women could be only slightly less at risk than men of their jobs being displaced. On average, approximately 20 percent of women in our sample—107 million women—could be at risk of losing their jobs in a midpoint automation scenario. This compares with 21 percent or 163 million employed men (Exhibit E4).[5] Patterns of potential jobs lost vary enormously between men and women as well as within countries; this is driven by the mix of occupations in which women and men tend to work within each country in our analysis, and the activities that make up these occupations.

Some activities, and therefore occupations, are more automatable than others. For instance, routine physical tasks and routine cognitive work are both highly automatable, but those requiring more complex cognitive, social, and emotional skills are less so. Men have high representation in routine physical roles such as machine operators and craft workers, and nearly 40 percent of jobs held by men that could potentially be lost to automation are in these categories. Conversely, women have high representation in many occupations with high automation potential due to their high share of routine cognitive work, such as clerical support worker roles and service worker roles; we estimate that this is where 52 percent of female job losses could be (compared with 27 percent of male job losses).

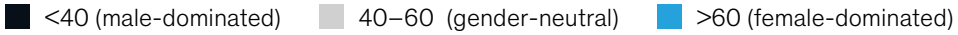
We also see differences among countries. In mature economies, men tend to lose machine operator jobs and women tend to lose clerical and service worker jobs. Emerging economies have a visible trend of jobs being lost in agriculture-related occupations for both men and women. Even here, however, patterns vary among emerging economies. For instance, in Mexico, agricultural work is one of the top three occupations driving job losses for men (21 percent of losses), but it is not in the top three for women. However, in India, where so many women work in subsistence agriculture, losses in this occupational category could account for 28 percent of jobs lost by women, compared with 16 percent of jobs lost by men. On the whole, our research shows that emerging economies could experience much lower levels of automation by 2030 relative to the size of their employed population than mature economies. This is because MGI's automation model takes into account the economic viability of implementing automation technology. Emerging economies tend to have lower labor costs (particularly in occupations with high levels of routine physical and cognitive work), suggesting that—at least over the next few years—the relative benefits of implementing automation technology will be less clear than they would be in higher-wage economies.

[5] All jobs lost and jobs gained percentage figures are represented as a share of 2017 male and female employment, respectively.

Exhibit E1

There are strong gender-based differences in employment within occupations and sectors in mature economies.

Occupation and sector gender mix, 2017
% of female workers out of total workers in sector and occupation category (weighted average across mature economies)[1]



	Elementary occupations	Clerical support workers	Agricultural and fishery workers	Service workers and shop and market sales workers	Machine operators and craft workers	Professionals, associate professionals, and technicians	Legislators, senior officials, and managers	**Simple average across countries**
	Wage increase →							
Accommodation and food services	59	66	21	60	30	50	45	**59**
Administrative and support and government	56	73	16	23	14	53	41	**42**
Agriculture, forestry, fishing, and hunting	51	86	30	50	12	42	21	**32**
Arts, entertainment, and recreation	47	63	28	51	17	45	39	**49**
Construction	7	80	0	21	2	20	12	**12**
Educational services	61	78	33	76	26	69	57	**66**
Finance and insurance	47	73	25	53	23	50	41	**54**
Healthcare and social assistance	72	87	4	84	27	76	66	**78**
Information	36	62	25	33	13	29	25	**35**
Manufacturing	33	56	34	42	25	25	20	**30**
Mining	11	63	8	16	4	19	16	**14**
Other services	62	82	22	51	17	50	49	**54**
Professional, scientific, and technical services	46	74	23	46	16	41	35	**44**
Real estate and rental and leasing	35	81	25	32	7	52	42	**44**
Retail and wholesale trade	36	62	51	54	20	49	31	**50**
Transportation and warehousing	24	48	33	46	10	27	22	**25**
Utilities	10	42	17	36	3	22	19	**20**
Simple average across countries	**45**	**72**	**24**	**60**	**15**	**52**	**31**	**47**
Median income[2] $ thousand, PPP	22.6	25.2	29.2	30.6	31.7	41.6	59.9	34.4

[1] Based on weighted average of Canada, France, Germany, Japan, the United Kingdom, and the United States.
[2] Determined by estimating the median income of each of the detailed occupations within each occupational category, and then calculating the median income across those detailed occupations.

Source: ILO, 2017; CPS IPUMs; ONS, 2017; Japan National Survey; EUROSTAT, 2015; Statistics Canada, 2016 Census; McKinsey Global Institute analysis

Exhibit E2

There are strong gender-based differences in employment within occupations and sectors in emerging economies.

Occupation and sector gender mix, 2017
% of female workers out of total workers in sector and occupation category (weighted average across emerging economies)[1]

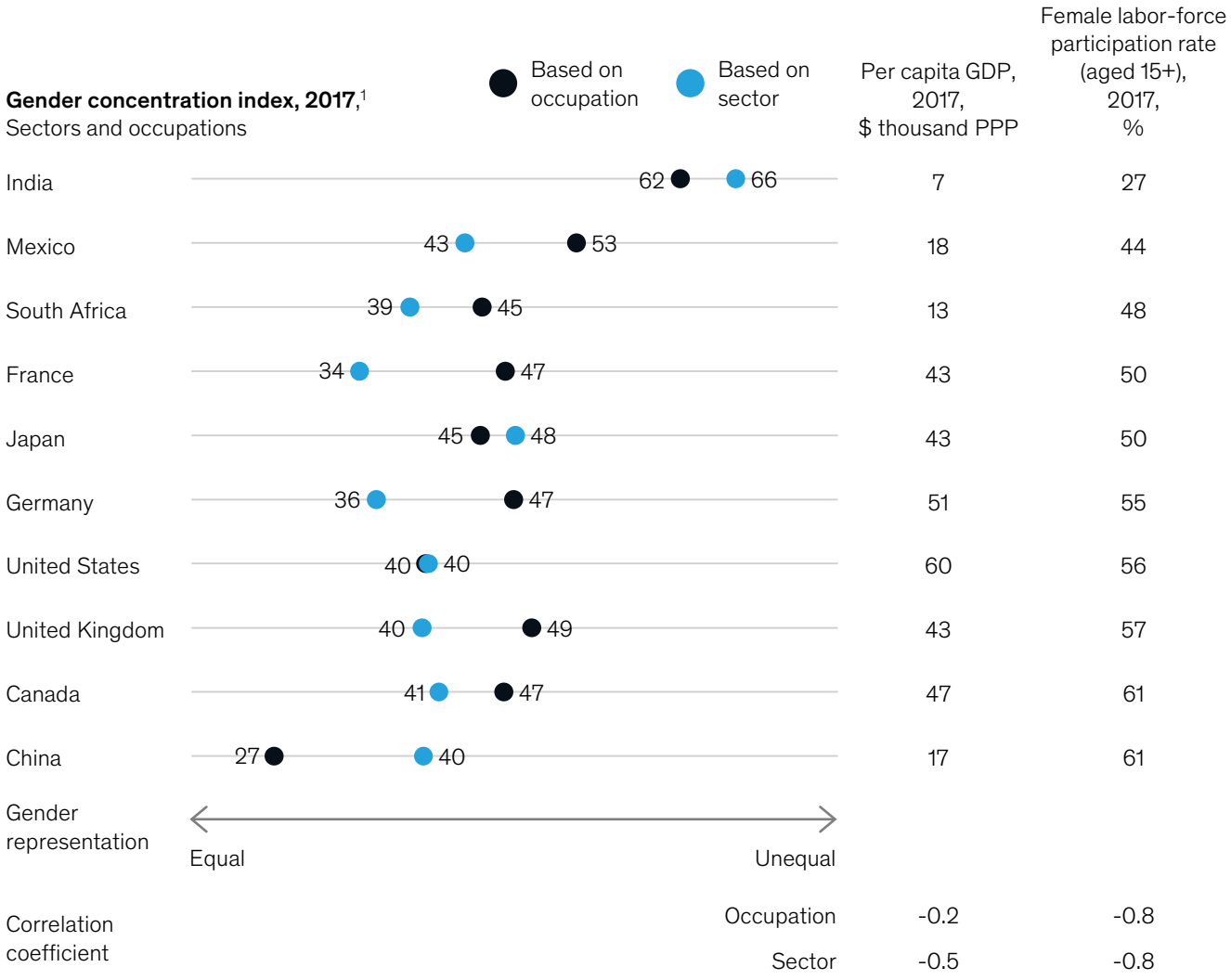
■ <40 (male-dominated) ■ 40–60 (gender-neutral)
■ >60 (female-dominated)

	Elementary occupations	Clerical support workers	Agricultural and fishery workers	Machine operators and craft workers	Service workers and shop and market sales workers	Professionals, associate professionals, and technicians	Legislators, senior officials, and managers	**Simple average across countries**[2]
	Wage increase →							
Accommodation and food services	10	32	4	35	28	18	20	**43**
Administrative and support and government	21	37	10	6	21	19	18	**25**
Agriculture, forestry, fishing, and hunting	37	15	34	12	25	32	15	**31**
Arts, entertainment, and recreation	2	30	3	5	18	18	56	**32**
Construction	18	53	4	13	14	15	4	**13**
Educational services	28	34	6	27	58	46	28	**53**
Finance and insurance	9	22	0	0	17	26	23	**41**
Healthcare and social assistance	40	46	2	20	67	49	34	**67**
Information	9	27	33	16	23	23	15	**31**
Manufacturing	24	28	29	30	28	16	25	**37**
Mining	21	41	1	10	27	4	6	**15**
Other services	70	25	28	5	63	14	21	**54**
Professional, scientific, and technical services	8	39	0	8	10	15	27	**33**
Real estate and rental and leasing	0	36	35	0	3	5	4	**35**
Retail and wholesale trade	14	25	2	5	14	11	14	**37**
Transportation and warehousing	2	17	2	1	41	19	3	**14**
Utilities	25	27	42	4	16	20	20	**21**
Simple average across countries	**35**	**43**	**29**	**22**	**43**	**41**	**25**	**39**
Median income[3] $ thousand, PPP	2.6	6.5	6.8	6.8	7.2	16.1	35.9	11.7

[1] Sector x occupation data are weighted average of India, Mexico, and South Africa. Data at the cross-tab level exclude China given limited data availability.
[2] Column and row averages include China data, and thus may appear higher than the cross-tab estimates (China is excluded from the cross-tab-level estimates due to data limitations).
[3] Determined by estimating the median income of each of the detailed occupations within each occupational category, and then calculating the median income across those detailed occupations.
Source: ILO, 2017; NSS; INEGI; China Population Census; South Africa Quarterly Labour Force Survey, 2018; McKinsey Global Institute analysis

Exhibit E3

Occupations tend to be more differentiated by gender than sectors; concentration also tends to be correlated with female labor-force participation.


Gender concentration index, 2017,[1]
Sectors and occupations
Based on occupation
Based on sector
Per capita GDP, 2017, $ thousand PPP
Female labor-force participation rate (aged 15+), 2017, %
India 62 66 7 27
Mexico 43 53 18 44
South Africa 39 45 13 48
France 34 47 43 50
Japan 45 48 43 50
Germany 36 47 51 55
United States 40 40 60 56
United Kingdom 40 49 43 57
Canada 41 47 47 61
China 27 40 17 61
Gender representation
Equal
Unequal
Correlation coefficient
Occupation -0.2 -0.8
Sector -0.5 -0.8

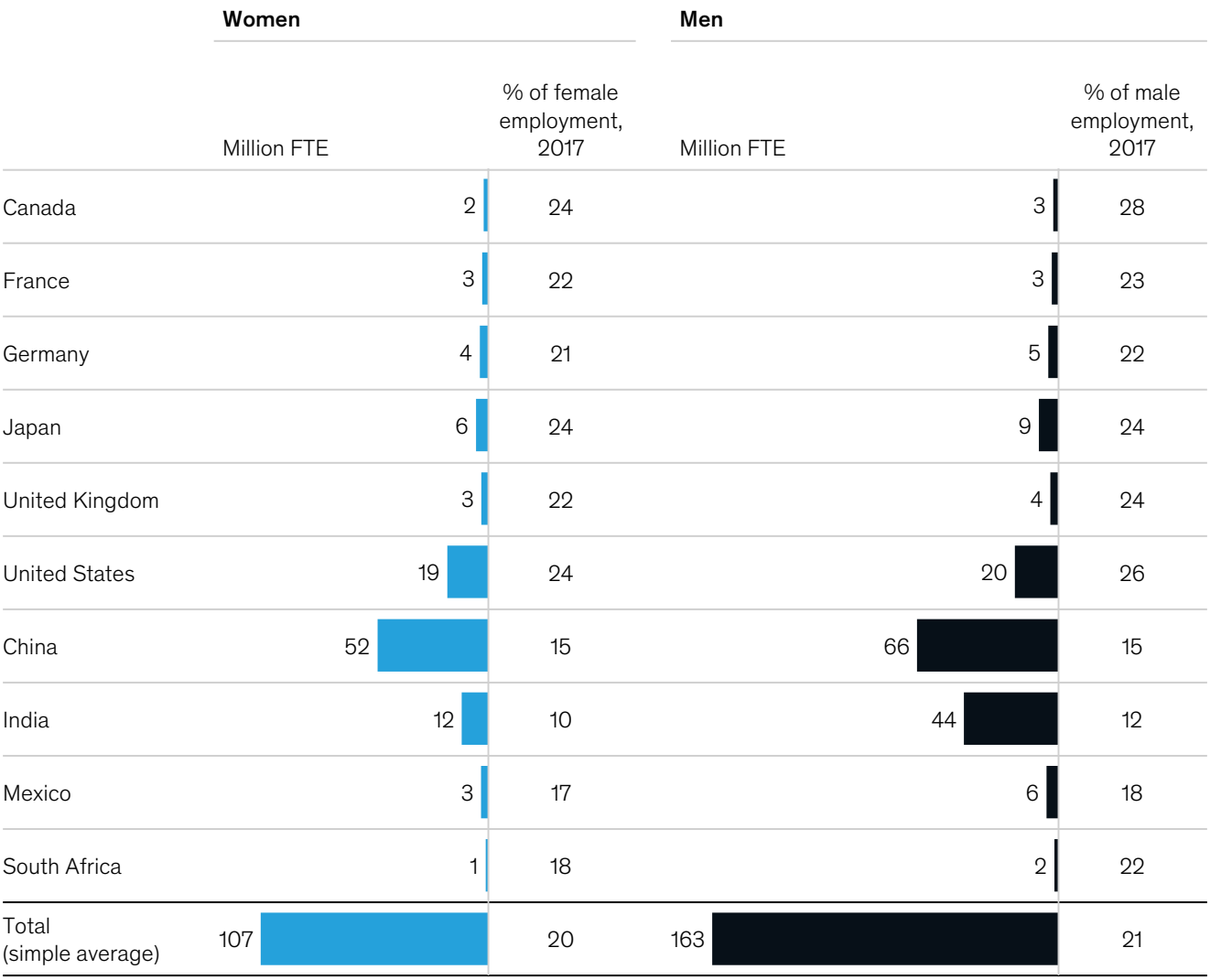
[1] The index measures the concentration of people of both genders in sectors and occupations. The index was created by calculating the sum of the squares of the distance from equal gender representation in each sector or occupation within a country, and then taking the square root. The index was then adjusted to fit a zero to 100 scale, with zero indicating equal representation and 100 indicating fully gendered occupations and sectors.

Source: CPS IPUMs; NSS; ILO, 2017; INEGI; Japan National Survey; Eurostat, 2015; South Africa Quarterly Labour Force Survey, 2018; World Bank; McKinsey Global Institute analysis

Exhibit E4

Women may be slightly less at risk of being displaced by automation than men.

Jobs at risk of being displaced by automation by 2030[1]


Women
Men
Million FTE
% of female employment, 2017
Million FTE
% of male employment, 2017
Canada 2 24 3 28
France 3 22 3 23
Germany 4 21 5 22
Japan 6 24 9 24
United Kingdom 3 22 4 24
United States 19 24 20 26
China 52 15 66 15
India 12 10 44 12
Mexico 3 17 6 18
South Africa 1 18 2 22
Total (simple average) 107 20 163 21

[1] Based on a midpoint automation scenario.

Note: Countries ordered based on mature and emerging economies, and alphabetically within each group.

Source: ILO, 2017; NSS; INEGI; China Population Census; South Africa Quarterly Labour Force Survey, 2018; CPS IPUMs; ONS, 2017; Japan National Survey; Eurostat, 2015; Statistics Canada, 2016 Census; McKinsey Global Institute analysis

Women could also experience job gains, assuming they maintain their current share of employment within sectors and occupations

Even with automation, demand for work and workers could increase as economies grow, partly fueled by productivity growth enabled by technological progress. Rising incomes and consumption (especially in emerging countries), increasing healthcare for aging societies, investment in infrastructure and energy, and other trends will create demand for work that could offset the displacement of workers. Women could be marginally better placed to capture these potential job gains relative to men because of expected robust growth in sectors where they are well represented. Before factoring in jobs displaced, by 2030 women could gain, on average, 20 percent more jobs compared with present levels (171 million jobs gained) versus 19 percent for men (250 million jobs gained) (Exhibit E5).[6]

~20%

more jobs could be gained by women vs ~19% for men by 2030

Women's slight advantage compared with men in their positioning to gain jobs reflects the fact that so many more women than men work in healthcare. Particularly in mature economies, demand for, and employment in, healthcare could grow significantly by 2030 as the population ages and the cost of care continues to rise. We estimate that, on average, 25 percent of jobs gained for women across our sample of ten countries will be in this sector, and 30 percent for our sample of mature economies.

We note that the main driver of potential job gains is sectoral, rather than occupational, representation. This reflects the fact that GDP growth—and therefore job creation—tends to be driven by consumption and investment, which then affects employment in sectors experiencing demand (and in the various occupations within each sector). However, it is important to note that women will be able to achieve these gains only if they are able to maintain their current share of employment within sectors and occupations in the labor market; if not, women could risk falling behind.

In the ten countries in our sample, on average 58 percent of potential gross job gains by women are driven by three sectors: healthcare and social assistance, manufacturing, and retail and wholesale trade. On average, 53 percent of men's potential gross job gains are in the manufacturing, retail and wholesale trade, and professional, scientific, and technical services (PST) sectors.[7] It may seem surprising that so many women could find employment in manufacturing given it is highly automatable, but there is significant scope for new jobs to be added in this sector as automation boosts productivity, fueling expansion. In emerging economies, manufacturing continues to be a major driver of job growth in the period to 2030.

[6] While the overall percentages for job displacement and incremental demand are roughly similar at 20 percent in each case for women, the millions of jobs to which they correspond is different—107 million potential jobs displaced for women, compared with 171 million incremental jobs demanded). This is because the overall percentages represent simple averages across countries, while the millions of jobs are a sum across countries.

[7] Professional, scientific, and technical services is a broadly-defined sector, which includes occupations in a variety of industries including legal, accounting, architectural, engineering, design, computer, consulting, research, advertising, photographic, translation, and veterinary services. This sector is broader than "tech" or "STEM," which refer to a narrower range of occupations.

Exhibit E5

Before factoring in potential job losses, women could expand their current employment by 20 percent by 2030, compared with a gain of 19 percent for men.

Demand for jobs in 2030, assuming constant female land male share of employment in sectors and occupations[1]

	Women		Men	
	Million FTE	% of female employment, 2017	Million FTE	% of male employment, 2017
Canada	2	24	2	23
France	2	15	2	16
Germany	4	23	5	24
Japan	2	8	3	6
United Kingdom	3	17	3	17
United States	15	19	14	18
China	112	33	120	28
India	23	19	91	24
Mexico	6	29	8	25
South Africa	1	13	1	9
Total (simple average)	171	20	250	19

[1] Figures represent a trend-line scenario of job creation that is based upon current spending trends, and excludes demand for entirely new occupations. In a forthcoming 2019 MGI report on the future of work in the United States, we will explore another scenario.

Note: Countries ordered based on mature and emerging economies, and alphabetically within each group. Analysis excludes jobs created in new occupations and unsized labor demand.

Source: ILO, 2017; NSS; INEGI; China Population Census; South Africa Quarterly Labour Force Survey, 2018; CPS IPUMs; ONS, 2017; Japan National Survey; Eurostat, 2015; Statistics Canada, 2016 Census; McKinsey Global Institute analysis

More than 150 million net jobs could be added in existing occupations and sectors by 2030

In our scenario to 2030 across the ten countries analyzed, approximately 150 million net jobs (factoring in both jobs displaced by automation and job creation) could be added in existing occupations and sectors, the vast majority of which could be in emerging economies. Mature economies could experience minimal net job growth or even a net decline as any gains in employment are counteracted by higher rates of automation adoption. Across the ten economies, 42 percent of net jobs gained (64 million jobs) could go to women and 58 percent (87 million) to men, if current employment trends in occupations and sectors hold and if both men and women can make the transitions required into available jobs.

Up to 9%

of employed people could work in entirely new occupations by 2030

In mature economies, positive net job growth could be concentrated in only two sectors: PST and healthcare. Today, women are well represented in the second but underrepresented in the first in many countries; in Canada, Japan, the United Kingdom, and the United States, women have lower representation in the PST sector compared with their average share in the economy.

In emerging economies, net job growth could occur in a broader range of sectors including manufacturing, accommodation and food services, retail and wholesale trade, and construction (on average, 57 percent of positive net jobs gained in India, China, and Mexico). We find that in China, Mexico, and South Africa women tend to outnumber men in accommodation and food services relative to their overall share of employment and tend to be underrepresented in manufacturing and construction. In India, women are slightly underrepresented relative to economy-wide participation in manufacturing and strongly underrepresented in construction and in accommodation and food services.

Many people could move into entirely new occupations, but women may face more challenges making this move

Waves of technological innovation displace or change the nature of many jobs, but they also create new ones, as was the case when economies shifted away from agriculture in the past. Historical trends in the United States suggest that up to 9 percent of the employed population could be working in entirely new occupations by 2030.[8] Examples from the past decade range from recently created jobs in machine learning and AI to ride-hailing drivers and roles in sustainability and resource management. If we extrapolate from trends in the United States across our sample of ten countries—recognizing that the United States is an imperfect comparison for many of these countries—this translates into more than 160 million additional jobs in entirely new occupations by 2030. This would be comparable to the *entire* net growth in labor demand for existing occupations (after accounting for jobs lost due to automation) in the sample of ten countries. Tapping into these jobs is therefore a major source of opportunity for women.

However, employment in new occupations may be more challenging for women than for men. MGI analysis of 135 recently created US occupations defined by O*NET in 2009 found that approximately 60 percent of jobs were in occupation categories that are male dominated, and only 16 percent female dominated. Other studies have also found that men are more likely to work in highly paid "frontier" jobs, a category of new occupations that involves the deployment of next-generation technology (for instance, AI specialists and roboticists).[9]

[8] Based on analysis conducted in Jeffrey Lin, "Technological adaptation, cities, and new work," *Review of Economics and Statistics*, May 2011, Volume 93, Number 2.

[9] David H. Autor, Frank Levy, Richard J. Murnane, "The skill content of recent technological change: An empirical exploration," *Quarterly Journal of Economics*, 118 (4), February 2003.

More women than men may experience partial automation of their work

Even if women and men remain in their current jobs, the ways in which they work are likely to change significantly as some of the component activities of their occupations are automated, creating "partial automation" of their work. As an illustration, the typical auto mechanic working in 2019 engages in a very different set of activities than the average mechanic in 1950. These workers now use hydraulic lifts and diagnostic computers rather than jacks and manual methods of diagnosis. However, the average number of auto mechanics has not declined in most countries; instead, mechanics have experienced a major transformation in the way they work because of partial automation.

55%

more time could be spent using technical skills in Europe and the United States by 2030

Some evidence suggests that women could be more likely to face partial automation than men. Using the United States as an example, we find that approximately half of occupations that are mainly held by women are less than 50 percent technically automatable by 2030, compared with about 20 percent of occupations largely performed by men.[10] If this pattern holds across countries, women could be at less risk than men of seeing their jobs replaced in their entirety by machines, but could be more likely to experience a fundamental change in their jobs (Exhibit E6).

As partial automation becomes more common and other technologies, including digital platforms that enable independent work, for instance, become more prominent, women's working lives (and men's) could change in three ways:

- **Work activities may shift in importance and could increasingly involve collaborating with automated systems.** As machines increasingly handle routine physical and cognitive tasks, women could spend more time managing people, applying expertise, and interacting with stakeholders. In an emergency room in 2030, for instance, health workers could spend less time doing clerical work (due to the adoption of preregistration by mobile phone, computerized checkout and billing, and AI-led diagnostic tools), and physical work, but more time interacting with patients.

- **Certain skills could become more important.** By 2030, jobs in Europe and the United States could require up to 55 percent more time using technical skills and 24 percent more hours using social and emotional skills.[11] Time spent using physical and manual skills and basic cognitive skills could decrease as those activities are automated.

- **More women could work flexibly.** Co-location with colleagues is an important part of working lives today, but technology could reduce the need to co-locate as telecommuting becomes more widely adopted, for instance. The rise of these new, more flexible ways of working is particularly helpful to women because they disproportionately carry the "double burden" of working for pay and working unpaid in the home in both mature and emerging economies.

Roughly 40 million to 160 million women globally may need to transition between occupations and skill levels

As jobs are lost and gained, women (and men) will need to transition across occupations and skill levels in order to achieve the 2030 scenario we have simulated. Our analysis suggests that across the ten countries studied, between 20 million and 100 million women may need to make transitions across occupations to ensure that they are positioned for shifts in labor demand. For men, we estimated that 35 million to 170 million men need to make these

[10] "Technical automatability" refers to a job's ability to be automated given technology that currently exists. This differs from our previous estimates of automation *adoption*, since it refers only to *technical* automation potential, whereas our automation adoption estimates accounted for economic and social factors that affected broader adoption rates across countries.

[11] *Skill shift: Automation and the future of the workforce*, McKinsey Global Institute, May 2018.

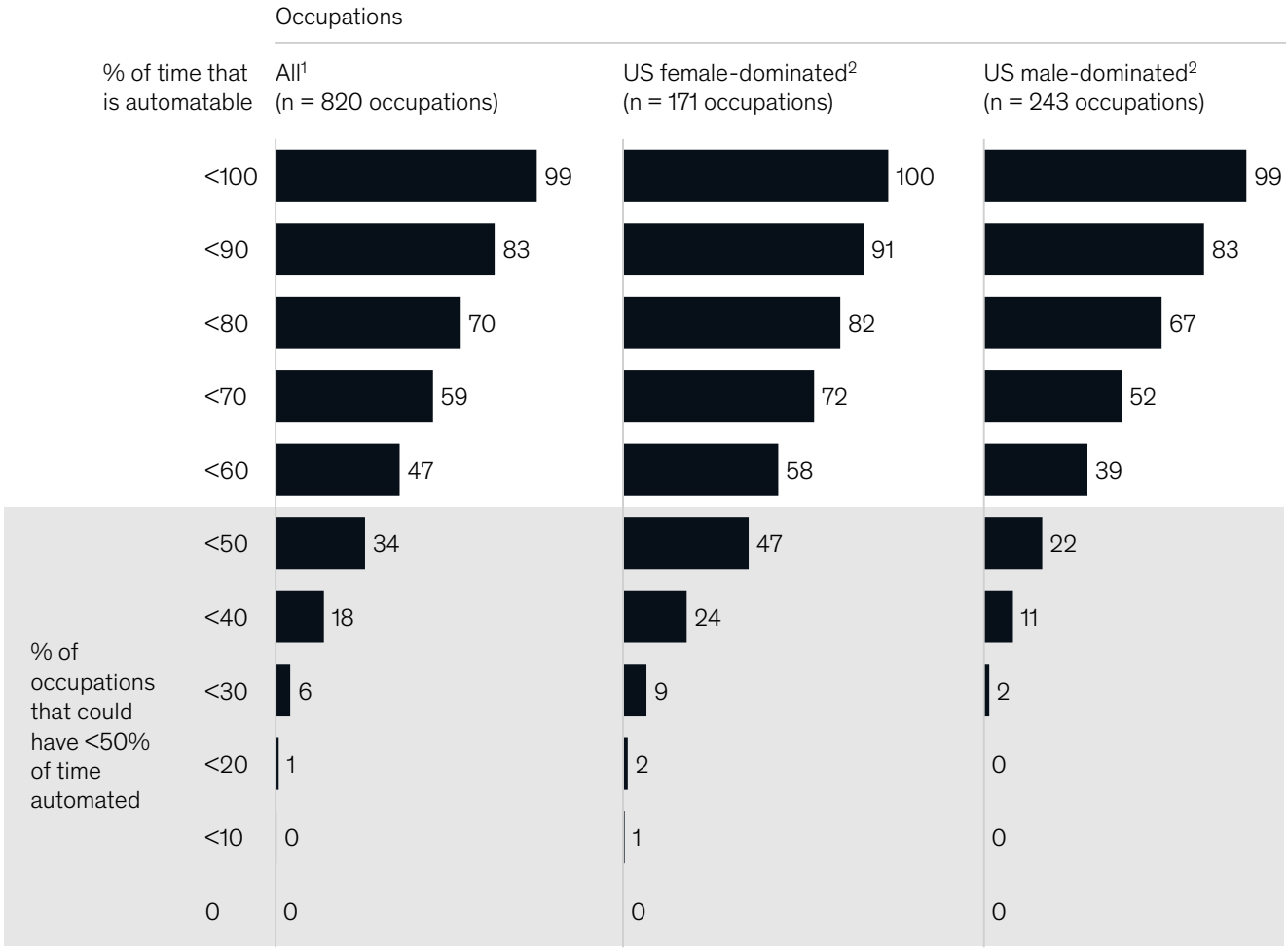
transitions. These wide ranges reflect different potential paces of diffusion of automation technologies, which is difficult to anticipate. The ranges are based on a midpoint automation adoption and an early automation—or rapid— adoption scenario. Extrapolating these findings globally, between around 40 million and 160 million women may need to transition across occupations—between 7 and 24 percent of women—compared with about 60 million to 275 million men, or 8 to 28 percent (Exhibit E7).

If women are able to navigate the necessary transitions, they may be able to maintain, or in some cases slightly increase, their current share of employment. However, if women are not able to make these transitions effectively, their share of employment could decline. To provide a sense of the impact this could have, we looked at how female share of employment would change if the 40 million to 160 million women dropped out of the labor force entirely rather than making job transitions. We acknowledge that this is an extreme outcome, but note it to help illustrate the imperative for successful transitions. In this hypothetical case, we found that the female share of employment could drop by one to seven percentage points, on average, across the ten countries studied between 2017 and 2030.

Exhibit E6

Nearly half of female-dominated occupations in the United States are less than 50 percent automatable, suggesting women could be more likely than men to experience partial automation of their jobs.

Partial automation within occupations,
% of occupations that could have time automated in 2030 based on midpoint technical automation potential



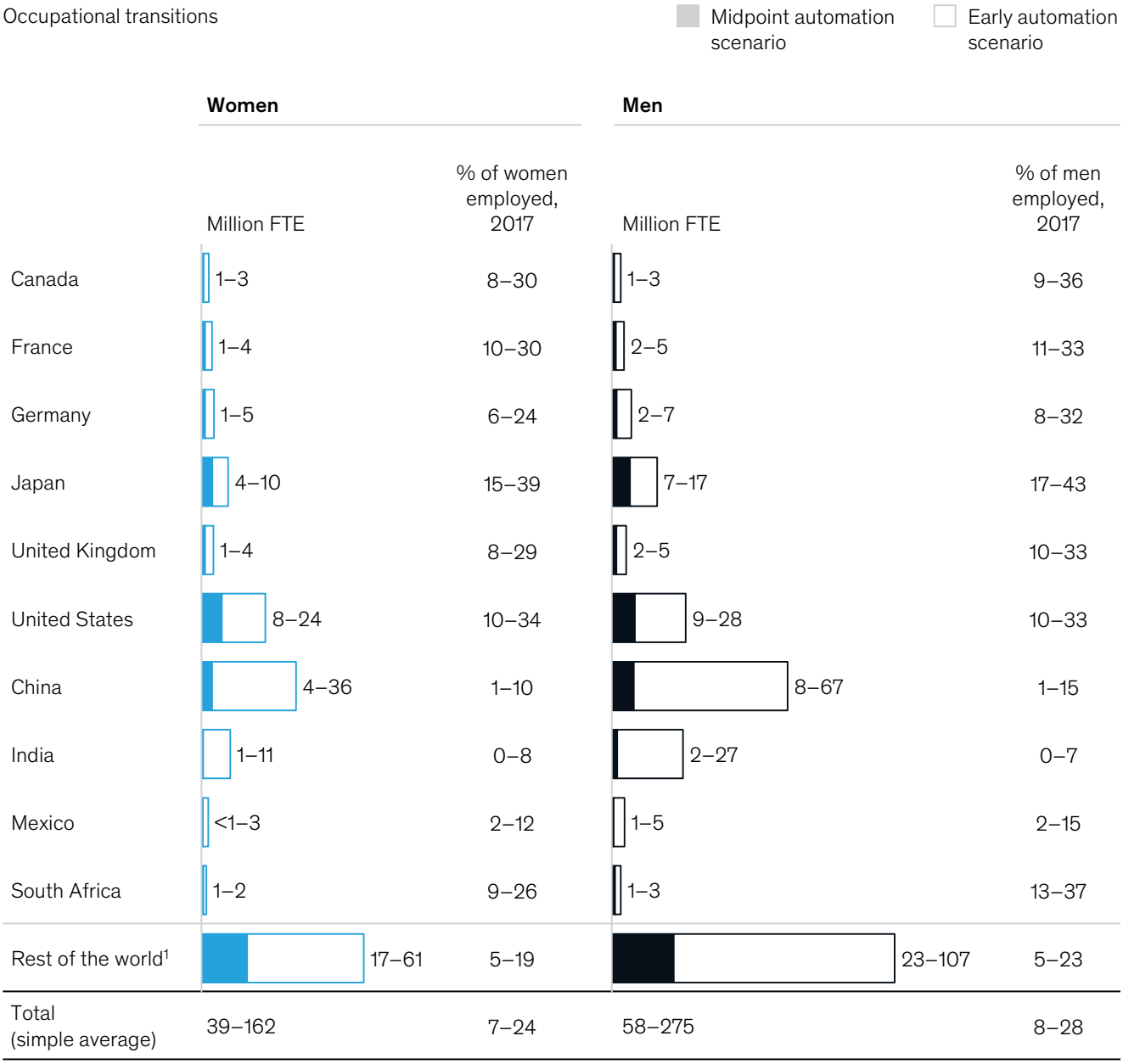
[1] Includes 820 occupations in United States Bureau of Labor Statistics (BLS) data that are female-dominated, male-dominated, and gender-neutral, as well as occupations that do not include gender splits.
[2] Female- and male-dominated means occupations with 60% or more female/male employee representation, respectively.

Source: US BLS; McKinsey Global Institute analysis

Exhibit E7

Roughly 40 million to 160 million women may face a need to transition across occupations and skill sets by 2030 to remain employed.

Occupational transitions


Midpoint automation scenario
Early automation scenario
Women
Men
Million FTE
% of women employed, 2017
Million FTE
% of men employed, 2017
Canada 1–3 8–30 1–3 9–36
France 1–4 10–30 2–5 11–33
Germany 1–5 6–24 2–7 8–32
Japan 4–10 15–39 7–17 17–43
United Kingdom 1–4 8–29 2–5 10–33
United States 8–24 10–34 9–28 10–33
China 4–36 1–10 8–67 1–15
India 1–11 0–8 2–27 0–7
Mexico <1–3 2–12 1–5 2–15
South Africa 1–2 9–26 1–3 13–37
Rest of the world[1] 17–61 5–19 23–107 5–23
Total (simple average) 39–162 7–24 58–275 8–28

[1] Extrapolated by mapping countries in the world to the most similar of the 10 countries studied in this report (53 countries in total) by applying rates of transition by gender to employment for each country.

Note: Countries ordered based on mature and emerging economies, and alphabetically within each group. Analysis excludes jobs created in new occupations and unsized labor demand. Figures represent a trend-line scenario of job creation. In a forthcoming MGI report on the future of work in the United States, we will explore another scenario.

Source: ILO, 2017; NSS; INEGI; China Population Census; South Africa Quarterly Labour Force Survey, 2018; CPS IPUMs; ONS, 2017; Japan National Survey; Eurostat, 2015; Statistics Canada, 2016 Census; McKinsey Global Institute analysis

Women will need higher educational attainment and skills to make successful transitions, thrive in existing jobs, and capture new opportunities

In mature economies, most women (and men) are likely to have to transition into occupations with higher educational requirements. In the six mature economies we include in our sample, net labor demand for jobs requiring a secondary education or an associate degree are likely to decline across the board.[12] In five of the six mature economies in our sample, net labor

[12] An associate degree is an undergraduate academic degree awarded by colleges and universities upon completion of a course of study intended to usually last two years or more. It is considered to be a higher level of education than a high-school diploma. This analysis excludes jobs in entirely new occupations.

demand is only seen growing for jobs with a college or advanced degree (Exhibit E8). In three of the four emerging economies in our sample—China, India, and Mexico—net labor demand is seen rising strongly for occupations requiring a secondary education for both men and women (Exhibit E9). In India, in particular, low-skill women in the agriculture sector could face a significant need to reskill as labor demand for jobs requiring less than a secondary education decline.

However, having the right education and skills is not enough to ensure that women successfully navigate the transitions needed for the workforce of the future. Women still face many barriers in the labor market, including the need to juggle paid employment with unpaid family responsibilities, as well as cultural barriers (this is the case in both emerging and mature economies).

These transitions are also characterized by job growth in higher-wage occupations that offers both opportunities and challenges

In the period to 2030, the adoption of automation technologies and the areas where jobs are created could drive a shift in labor demand toward higher-paid jobs. The situation carries both opportunity and risk for women. If they manage to transition between occupations and retrain themselves to meet demand for jobs that are higher-paying and associated with different skills, they could be looking at a future of more productive and more lucrative employment. However, if they cannot make the necessary transitions, many women could face an intensifying wage gap relative to men.

In all the mature economies studied, demand for low- and middle-wage jobs may contract by 2030. Workers in middle-wage jobs in mature economies could be the most vulnerable. In general, although demand for low-wage labor could also decline, low-wage workers could be somewhat less at risk of job loss than middle-wage workers since their wages are often too low to justify the cost of implementing automation technology. Meanwhile, middle-wage workers in mature economies are often in jobs with a high degree of automation potential, such as plant and machine operation, with significant enough earnings to make automation cost-effective.

In four out of the six mature economies studied, men in middle-wage jobs could face a higher risk of job loss than women as a share of their current employment in that income category. Low- and middle-wage men in mature economies are likely to bear the brunt of labor-market displacement from automation, due to their high representation in machine operation and craft worker occupations. However, there may be crucial second-order effects upon women. A reduction in demand for low- and middle-wage workers could cause displaced men increasingly to compete for jobs with women, exerting downward pressure on wages. Evidence suggests that the labor supply of women is typically more responsive to wage pressure than that of men. For instance, one meta-analysis found that the wage elasticity of labor supply for women may be as much as five times that of men in mature economies.[13] Women may, therefore, leave the labor market more readily than men when facing downward pressure on wages. Moreover, in many countries, cultural attitudes favor the man being the primary earner; if women's wages come under significant pressure, the cost-benefit of working versus not working may not make sense for many women.[14] Structural challenges are associated with dual-earner households (for instance, higher tax rates and additional childcare costs) that could encourage women in those households to leave the labor force if the costs associated with employment become too high. The imperative is high for women to reskill in order to weather these potential disruptions from shifting labor demand.

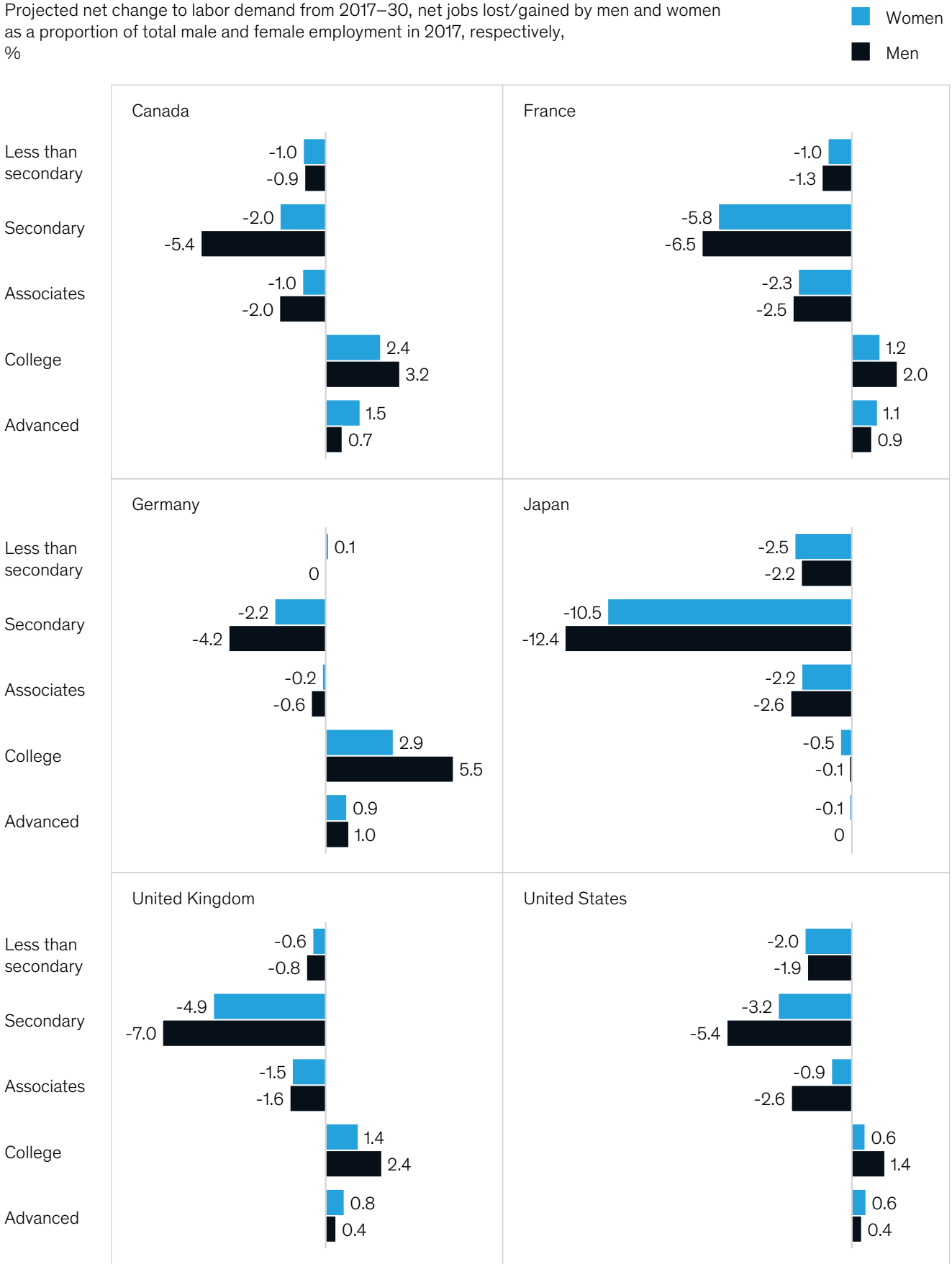
[13] Michiel Evers, Ruud De Mooij, and Danial Van Vuuren, "The wage elasticity of labour supply: A synthesis of empirical estimates," *De Economist*, March 2008, Volume 156, Issue 1.

[14] We have analyzed the World Values Survey and Organisation for Economic Co-operation and Development (OECD) data and found a strong link between societal attitudes that limit women's potential and gender-equality outcomes in a given region. Globally, 60 percent of respondents agreed with the statement that men have more right to a job than women when jobs are scarce. See *WVS Wave 6 (2010–2014),* worldvaluessurvey.org/WVSDocumentationWV6.jsp.

Exhibit E8

In mature economies, men and women could only experience net growth in labor demand in jobs with higher educational requirements.

Projected net change to labor demand from 2017–30, net jobs lost/gained by men and women as a proportion of total male and female employment in 2017, respectively, %



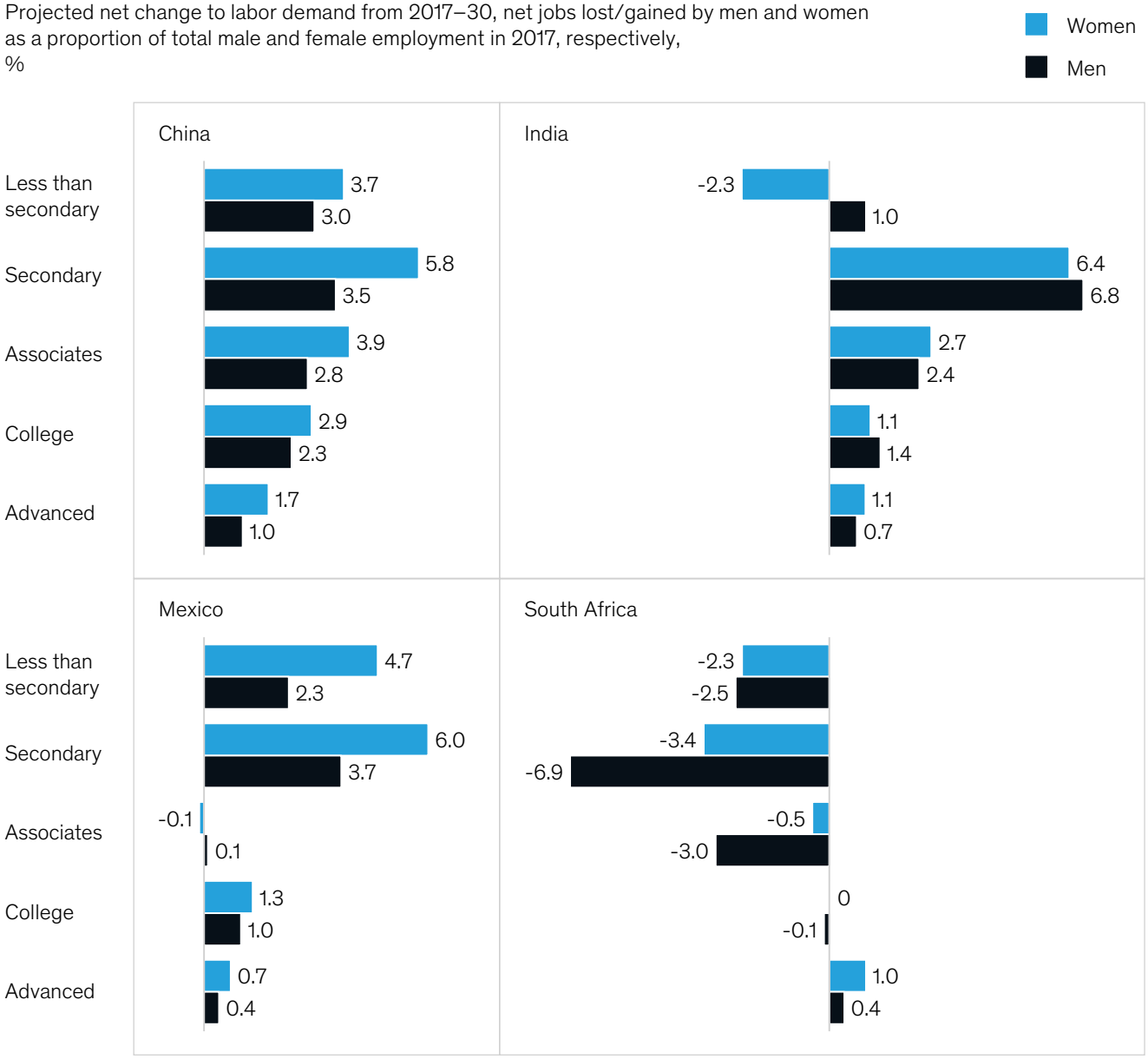
Note: These data are based upon a midpoint scenario of automation and a trend-line scenario of job creation. Analysis excludes jobs created in new occupations and unsized labor demand.

Source: CPS IPUMs; ONS; 2017; ILO, 2017 ; Japan National Survey; Eurostat, 2015; Statistics Canada, 2016 Census; McKinsey Global Institute analysis

Exhibit E9

In most emerging economies, men and women could experience growth in labor demand across all education levels, with the largest gains at the secondary education level.

Projected net change to labor demand from 2017–30, net jobs lost/gained by men and women as a proportion of total male and female employment in 2017, respectively, %



Note: These data are based upon a midpoint scenario of automation and a trend-line scenario of job creation. Analysis excludes jobs created in new occupations and unsized labor demand.

Source: ILO, 2017; NSS; INEGI; China Population Census; South Africa Quarterly Labour Force Survey, 2018; McKinsey Global Institute analysis

In emerging economies, demand from employers for jobs in the low-, medium-, and high-wage categories could grow in the period to 2030 for most countries. This reflects robust economic growth and the fact that relatively lower wages overall mean that the incentive for automation is somewhat weaker—for now. However, in India and China, labor demand for medium- and high-wage jobs is growing rapidly, outpacing that of low-wage jobs. This presents a challenge for low-wage women (and men) to eventually develop the skills needed to take up medium- and high-wage jobs. This will be particularly true of India, where the agriculture sector, which today employs about 60 percent of the female working population, is poised to contract.

The gender wage gap could narrow in some countries if women make the necessary transitions but could widen if they don't

Gender wage disparity is also a feature of both mature and emerging economies. Currently, more men tend to be employed in the highest-paying occupations compared with women. In our sample of mature economies, for example, 5 percent of women are in the highest-paying legislator, senior official, and manager occupations, compared with 8 percent of men. At the same time, a higher percentage of employed women work in the two lowest-paying occupational categories—elementary occupations and clerical support work. Twenty-five percent of women are employed in these roles, compared with 15 percent of men. In emerging economies, women and men hold a comparable number of jobs in the professional, associate professional, and technician occupational category, but more men work in the legislator, senior official, and manager occupational category. Twenty-eight percent of women are employed in the lowest-paying category (elementary occupations), compared with 22 percent of men.

5%

of women in mature economies work in the highest-paying legislator, senior official, and manager occupations vs 8% of men

Looking ahead to 2030, our scenario suggests that gender wage disparity may lessen slightly in certain mature economies if women are able to gain the necessary skills and successfully navigate the occupational transitions we have discussed. Women could make inroads in the relatively high-paying professional and associate professional occupation category (for example, 38 percent of women in mature economies could be in this group by 2030, compared with 34 percent in 2017), and the bulk of women's job losses could occur in relatively low-paying occupational categories such as clerical services (for example, 14 percent of women in mature economies could be in this group by 2030, a decline from 17 percent in 2017). However, it is important to note that men could still outnumber women in the highest-paying occupation category: legislators, senior officials, and managers. For instance, in our scenario, 9 percent of men in mature economies could be employed in these high-paying leadership roles, compared with only 6 percent of employed women.

If women are not able to make effective transitions into higher-wage occupations such as the professional category, the gender gap may worsen, or women could become unemployed or drop out of the labor force entirely. In emerging economies on average, both men and women face an imperative to transition away from lower-wage occupations like agriculture into higher-wage occupations such as professional and service worker roles.

Women will need to be skilled, flexible and mobile, and tech-savvy, and will need measures to overcome challenges in all three areas

Women and men face a period of disruption and change. It will be vital for both to develop (1) the skills that will be in demand; (2) the flexibility and mobility needed to negotiate labor-market transitions successfully; and (3) the access to and knowledge of technology necessary to work with automated systems, including participating in its creation. Unfortunately, women face long-established and pervasive structural and societal barriers that could hinder them in all three of these areas, a situation that has made progress toward gender equality in work slow.

The good news is that the forces of technology and innovation that characterize the automation age can also pave the way for more gender equality in the workforce. Digital and internet technologies offer women a way to break down barriers by making reskilling more

accessible and enabling flexible working, for instance. Moreover, private- and public-sector leaders have a huge opportunity to support women as they navigate impending transitions. We describe three priority areas for targeted interventions, some of which apply to both men and women and some of which are geared toward addressing the specific challenges women face (Exhibit E10).

Women need a range of measures to help them develop the skills they will need to make successful labor-market transitions

Women around the world have made significant strides in educational attainment, but there is room for more progress, and for targeted reskilling to enable them to develop the capabilities that will be in demand.

Women in mature economies are generally graduating at rates on a par with, or even higher than, men. In developed economies, more women than men graduate with at least a secondary degree, according to the World Economic Forum (WEF) and UNESCO. For instance, in Western Europe, on average 90.9 percent of women attain a secondary degree, compared with 90.5 percent of men, and on average 79.8 percent of women hold a tertiary qualification, compared with 66.7 percent of men.[15] However, they still need to match their skills as closely as possible to where the most job opportunities will be. There is some concern that women are not acquiring skills needed for high-growth fields such as PST. For instance, in the United Kingdom, of first-year full-time students gaining a higher education, only 37 percent of women studied science subjects in 2016–17, compared with 48 percent of men.[16] Women already in the workforce also need to reskill to meet the needs of the jobs of the future.

~60%

of employed women in India are in agriculture with a narrow set of skills

In emerging economies, education of girls and women has improved markedly in recent years, suggesting that women should be better positioned now than in the past to take advantage of shifts in labor demand. However, large gender gaps persist in education, and even more so in the skills that women will need. In low- and lower-middle-income countries such as India, where about 60 percent of employed women are in agriculture and tend to have a narrow set of skills that may be hard to adapt, transitioning into new occupations and sectors is likely to be highly challenging. More than ever, women must embrace lifelong learning from school to employment and throughout their working lives.

To address these needs, the private sector can invest more in training and reskilling employees within companies or in partnership with academic and other institutions. In China, for instance, the All-China Women's Federation has forged partnerships with private-sector companies including Alibaba to provide training and networking for women, especially in e-commerce and technology sectors.[17] Increasingly, midcareer workers will need to refresh or develop new skills; in 2018, 54 percent of employers were providing additional training and development opportunities to their existing workforce in order to fill skills gaps, compared with only 20 percent in 2014.[18] Governments can contribute by providing women with subsidies and financial support to finance training and reskilling. Singapore's SkillsFuture Credit provides all Singaporeans aged 25 and over a credit of approximately S$500 (approximately $360) to use for approved work-related skills programs.[19] Public and private investment in digital learning platforms would open up another avenue for women. One example of this is Goldman Sachs' 10,000 Women initiative, which has an online education partnership with Coursera that provides female entrepreneurs with access to a free digitized

[15] Note that net secondary education is the percentage of girls and boys in the official age range for secondary education who are enrolled in secondary education. Gross tertiary education is the total enrollment in tertiary education, regardless of age, expressed as a percentage of the most recent five-year age cohort that has left secondary school. See *The global gender gap report*, World Economic Forum, 2018.

[16] *Higher education student statistics: UK 2016/17 – qualifications achieved*, Statistical First Release SFR247, HESA, January 11, 2018.

[17] *The power of parity: Advancing women's equality in Asia Pacific*, McKinsey Global Institute, April 2018.

[18] *Solving the talent shortage*, 2018 Talent Shortage Survey, Manpower Group, 2018, **manpowergroup.co.uk/wp-content/uploads/2018/07/MG_TalentShortage2018.pdf.**

[19] *About SkillsFuture,* SkillsFuture Singapore, **skillsfuture.sg/AboutSkillsFuture.**

Exhibit E10

Government, industry, education, and NGO leaders will all play a role in supporting job transitions for women.

			Key actors		
	Interventions	Examples of potential initiatives	Govern-ment	Private sector	NGOs
Support skill-building efforts	Invest in training and reskilling	• Training and apprenticeship programs for women • Reskilling opportunities for midcareer women or women returning to workforce	●	●	●
	Subsidize transition costs	• Government or corporate reskilling subsidies for targeted occupations and sectors • Childcare subsidies for parents undergoing reskilling or pursuing higher education	●	●	
	Invest in digital platforms	• Industry partnerships with massive open online courses (MOOCs)		●	●
	Increase transparency on labor demand trends	• Technical school or university curriculums co-created with industry • Informational campaigns targeting women		●	●
Address labor mobility constraints	Help women balance paid and unpaid care work	• Public or corporate policy interventions to provide universal or accessible childcare • Corporate policy changes to promote flexible or telecommuting work options	●	●	
	Invest in transportation infrastructure and public safety	• Investment in more efficient public infrastructure • Campaigns to increase bystander awareness of harassment	●		
	Foster more dynamic career paths and enable women's access to networks	• Intrafirm and cross-sector networks and mentorship opportunities for women • Sponsorship of network-building organizations for women • Increased unconscious bias training in performance reviews and hiring practices • Digital talent platforms to help women find opportunities		●	
	Reduce stereotypes about gendered occupations	• Increased pubic visibility of female role models in male-dominated industries (eg, through diverse panels at speaking engagements)		●	
	Enhance social protections and safety nets for workers	• Labor agencies equipped to support and reskill the unemployed • Unemployment insurance or universal basic income policies	●		
Increase women's representation in and access to technology	Create pathways for women in STEM	• Partnerships to increase exposure to STEM opportunities for girls and women from primary school to university • Internship, apprenticeship, and mentoring programs for women in STEM • Sponsorship of women pursuing advanced education in STEM	●	●	●
	Increase access to basic technology for women in emerging markets	• Investment in internet and mobile infrastructure	●	●	
	Provide more support for women to develop digital skills	• Digital and mobile literacy programming targeting women in emerging economies	●		●
	Ease path for women to work in gig economy	• Increased worker protections for independent workers	●	●	
	Address funding gap for women entrepreneurs	• Strengthened entrepreneurship ecosystem for female founders • Increased diversity within venture capital firms • Increased microfunding and access to credit to female entrepreneurs in emerging markets		●	

Source: McKinsey Global Institute analysis

curriculum tailored to meet the needs of female business owners in emerging markets.[20] Finally, as labor demand shifts, it is important to ensure that skills development matches market demand; doing so will require employers to provide clear and transparent signals to women (for example, through online targeting of women and information campaigns).

Interventions are needed to help women improve their flexibility and mobility

Labor mobility and flexibility help women and men move between employers, occupations, sectors, and geographies as needed in order to respond to the needs of an evolving labor market. However, women tend to face more structural challenges in this area than men.

Women are less mobile and flexible because they spend much more time than men on unpaid care work—more than 1.1 trillion hours a year, compared with less than 400 billion hours for men.[21] Governments can help give women the flexibility to ease their double burden through subsidized maternity and parental leave and childcare. Companies can offer flexible workplace policies, but one 2018 survey of employers found that only 23 percent were doing so.[22] Globally, nearly 40 percent of women in wage employment do not have access to social protection such as pensions, unemployment benefits, or maternity protection.[23]

Another factor limiting women's mobility is that women—in both mature and emerging economies—face dangers to their physical security when traveling, potentially limiting where they can find employment. Several countries have attempted to improve women's mobility by introducing women-only train cars and other gender-segregated travel options. In emerging economies, limited access to—and poor safety on—transportation systems is regarded as the greatest obstacle to women's participation in the labor market, especially in the formal economy. One study estimated that this issue reduced the probability of women in low-income economies participating in the labor market by 16.5 percentage points.[24]

1.1t

hours of unpaid work each year by women vs 400b for men (OECD)

Women also don't have access to the same extent as men to networks that help them to develop their skills, achieve career progression, and transition into new jobs. Some companies are moving ahead on this front. US-based hotel company Hilton has created networking groups for women and other underrepresented groups of employees.[25]

Persistent gender concentration within occupations and sectors also makes it more difficult for women (and men) to cross over into roles where they currently are the minority of workers. More effort is needed to combat stereotypes that entrench gender concentration in some occupations. For instance, companies and other organizations can actively seek to increase the number and visibility of role models to counteract gender-biased representation of men or women in the media.

As they transition into different occupations or sectors, women (and men) may need financial support, including social safety nets like unemployment benefits and insurance. Labor agencies can focus on providing benefits and assistance to the unemployed: serving as job counselors, offering career guidance, and enabling access to potential training and job opportunities for those temporarily out of the workforce. In Germany, caseworkers are assigned to every unemployed individual and offered incentives to find their clients work. This policy, among others, helped to reduce Germany's unemployment from 10 percent in 2003 to below 5 percent by 2015.[26]

[20] *Goldman Sachs 10,000 Women launches online education partnership with Coursera,* Goldman Sachs, May 21, 2018.
[21] OECD Gender, Institutions and Development Database 2018, United Nations Department of Economic and Social Affairs, Population Division (2017 revision).
[22] *Solving the talent shortage*, 2018 Talent Shortage Survey, Manpower Group, 2018.
[23] "Gender differences and why they matter," Chapter 5 in *World Development Report 2012,* World Bank, September 2011 http://siteresources.worldbank.org/INTWDR2012/Resources/7778105-1299699968583/7786210-1315936222006/chapter-5.pdf
[24] *World employment social outlook: Trends for women,* International Labour Organization (ILO), 2017.
[25] *Women in the workplace 2018,* McKinsey & Company and Lean In, October 2018.
[26] Niklas Engbom, Enrica Detragiache, and Faezeh Raei, *The German labor market reforms and post-unemployment earnings,* IMF working paper number 15/162, July 2015.

Women must be more engaged in technology—more access, more skills, and more participation in its creation—to thrive

Technology can break down many of the barriers facing women, opening up new economic opportunities, helping them to participate in the workforce, and, in the automation age, enabling the navigation of transitions. For example, women are now employed independently in what is popularly known as the gig economy, taking advantage of technology that enables new and more flexible ways of working.[27] In middle-income emerging economies, increased connectivity, the low cost of labor, and a rise in e-commerce have propelled an increase in gig work as an alternative to traditional self-employment. Additionally, the flexibility of using technology platforms, often from home, helps to explain why so many women have become e-commerce entrepreneurs. For example, a McKinsey survey in Indonesia found that women-owned micro, small, and medium-size enterprises (MSMEs) generate 35 percent of e-commerce revenue, compared with only 15 percent of offline MSME revenue.[28]

<20%

of tech workers are female in many mature economies

However, women continue to lag behind men in their access to technology, the skills to use it, and employment in tech sectors. It is also vital that women participate in the creation of technology, not only because diverse teams have distinct benefits, but also because their contribution can help provide a diverse set of inputs as AI algorithms are created, thereby helping to tackle concerns about inbuilt gender bias in such algorithms.[29]

Globally, men are 33 percent more likely than women to have access to the internet; that gap worsens when focusing on women in poor, urban communities.[30] Women also lag behind men in developing tech skills. Around the world, women account for only 35 percent of science, technology, engineering, and math (STEM) students in higher education.[31] Women are significantly underrepresented in tech jobs—less than 20 percent of tech workers are female in many mature economies.[32] Only 1.4 percent of female workers in OECD countries have jobs developing, maintaining, or operating information and communications (ICT) systems, compared with 5.5 percent of male workers.[33]

A number of interventions are needed to address these challenges. First, there is a need to create pathways for women in STEM fields. The Canadian government's Science campaign aims to encourage young women to pursue careers in the sciences.[34] Nonprofits across the world, from Afghanistan to the United States, are focused on developing girls' coding skills.[35] Companies in STEM fields can invest in and partner with nonprofits and colleges to develop a broader pipeline of women in tech. Via partnerships, companies can, for instance, support women's communities and clubs by offering networking or early internship opportunities.[36] Second, women's access to basic enabling technology needs to expand. In emerging economies in particular, improving women's access to the internet and mobile technologies

[27] Independent work, also known as the gig economy, is defined by three characteristics: a high degree of worker autonomy, payment by task, and a short-term relationship between worker and client. For a broad discussion of the gig economy, see *Independent work: Choice, necessity, and the gig economy*, McKinsey Global Institute, October 2016.

[28] McKinsey survey of Indonesian e-commerce merchants, 2017. N = 700.

[29] On the benefits of diversity, McKinsey research has found that companies in the top quartile for gender diversity in their executive teams were 21 percent more likely to experience above-average profitability than companies in the fourth quartile. See *Delivering through diversity*, McKinsey & Company, January 2018. On the risk of bias in AI, see, for instance, Moritz Hardt, *How big data is unfair*, Medium, September 26, 2014; Tom Simonite, "Machines taught by photos learn a sexist view of women," *Wired*, August 21, 2017; Eva Noble, *Without data equality, there will be no gender equality*, Women Deliver, June 11, 2018; and Hope Reese, *Bias in machine learning and how to stop it*, TechRepublic, November 18, 2016.

[30] *The case for the web,* The Web Foundation, 2018.

[31] *Taking stock: Data and evidence on gender equality in digital access, skills and leadership,* EQUALS Global Partnership, 2018.

[32] The share of women in tech is different from the share of women in the PST sector, which encompasses a variety of industries including legal, accounting, architectural, engineering, design, computer, consulting, research, advertising, photographic, translation, and veterinary services. A forthcoming McKinsey research report, *The diversity opportunity in tech,* will provide further detail.

[33] *Taking stock: Data and evidence on gender equality in digital access, skills and leadership, EQUALS Global Partnership, 2018.*

[34] *Government of Canada launches interactive campaign to build network of mentors for young women in science,* Innovation, Science, and Economic Development Canada, February 2018.

[35] *Cracking the code: Girls' and women's' education in science, technology, engineering, and mathematics (STEM),* United Nations Educational, Scientific and Cultural Organization, 2017.

[36] *Rebooting representation: Using CSR and philanthropy to close the gender gap in tech,* McKinsey & Company and Pivotal Ventures, 2018.

can provide them with gateways to online learning and independent work platforms. GSMA estimates that there are 433 million unconnected women in emerging economies.[37]

Third, women need more help to develop their digital skills. In India, Google and Tata Trust fund the Internet Saathi program to increase digital literacy among rural women.[38] However, more needs to be done. In a 2015 study, GSMA said that it had found few examples of large-scale initiatives specifically focused on teaching women mobile literacy and digital skills, but, on a positive note, said that a number of mobile network operators had begun to address the gap in developing countries.[39]

~433m

unconnected women in emerging economies (GSMA)

Fourth, barriers to women working in the gig economy must be addressed. This includes concerns about physical security (in food delivery or ride-sharing, for instance), lower access to internet and mobile devices among women, and less social protection than for formally employed workers. Finally, more can be done to address the funding gap faced by women entrepreneurs as part of a broad effort to actively encourage women to create technology and work in new ways. Consider that, in 2018, all-male founding teams received 85 percent of total venture capital investment in the United States, while all-women teams received just 2 percent, and gender-neutral teams just 13 percent.[40] The numbers in Europe are even lower, with 93 percent of 2018 capital raised going to all-male founding teams.[41] There is an imperative for investors to step up efforts to promote gender diversity and eliminate gender bias in funding. The World Bank's Women Entrepreneurs Finance Initiative funds efforts to tackle both financial and nonfinancial constraints faced by women entrepreneurs in emerging markets. In its first round of approved projects, it expects to mobilize more than $800 million in new financing to women-owned and -led small and medium-size enterprises.[42]

The world of work is undergoing a radical transformation as automation technologies spread. Automation could displace many women, affect their earnings, and require millions to seek work in other occupations or sectors. New opportunities will emerge, too, given that many women work in fast-growing sectors such as healthcare. However, in order to thrive and advance in the automation era, many millions of women will need to make challenging transitions between occupations and develop new skills. Women are likely to face unique difficulties in making these transitions effectively—and therefore positioning themselves for the automation era and preserving their job prospects—because of stubborn structural barriers in the labor market.

Times of significant technological change undoubtedly bring challenges, but digital, internet, mobile, and AI can also open new doors to women to gain skills, to secure higher-paying jobs, and to become entrepreneurs. It is vital that everything possible is done to help women overcome the challenges and seize the opportunities of the automation age. There are concrete, practical ways that leaders in the public, private, and social sectors can—and should—support women in these areas. If they offer active measures to help lower barriers to women's ability to respond to the disruption of automation dynamically and effectively, women could maintain or even slightly improve their relative position in the labor market in certain economies—benefiting not only women but also the global economy. If they do not take necessary measures, women could fall further behind in the world of work.

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[37] *Connected women, The mobile gender gap report 2019,* GSMA, 2019.
[38] "Google, Tata Trusts to expand Internet Saathi programme," Hindu Business Line, January 2018.
[39] *Accelerating digital literacy: Empowering women to use the mobile internet*, GSMA, 2015.
[40] Kate Clark, *Female founders have brought in just 2.2% of US VC this year (yes, again)*, TechCrunch, December 2018.
[41] *Diversity & inclusion in tech: A practical guidebook for entrepreneurs*, Atomico, 2018.
[42] *Women Entrepreneurs Finance Initiative allocates first round funding: Expected to mobilize twice the original target,* World Bank, April 19, 2018.

Box E2

Countries exhibit differences and similarities in patterns of women's future work

Some dynamics and patterns in the future of work are similar whether we are looking at mature or emerging economies, but differences exist between the two groups, for countries within in each group, as well as between men and women within these countries (Exhibit E11).

Gendered work. In mature and emerging economies alike, men and women cluster in certain occupations and sectors. However, an inverse relationship exists between gender concentration and women's labor-force participation—when more women participate, gender concentration diminishes as women cross gender lines. China stands out, with both high female participation and less gender concentration in occupations. In India, by contrast, participation is relatively low, as is diversity within occupations and sectors.

Jobs lost. The risk of automation for both men and women tends to be higher in countries with higher per capita GDP where wages tend to be higher and where, therefore, the incentive is greater to replace labor with automated processes and systems. Looking at gender differences, we find that, on average, the share of jobs lost for women is slightly lower than the share of jobs lost for men across the ten countries in our sample. This trend generally holds for both mature and emerging economies; however, in Japan and China, the difference in share of jobs lost between men and women is negligible. While the overall automation risk is roughly similar for men and women, sector and occupation patterns of jobs lost for men and women look different, driven by variations in the occupations in which men and women tend to work. A combination of clerical support occupations and service and sales occupations make up the bulk of job losses for women in mature economies (on average 58 percent), while service and sales occupations and machine operators and craft occupations drive the majority of losses for women in emerging economies (on average 55 percent). It is important to note that, in India, agricultural occupations account for close to 30 percent of losses for women.

Jobs gained. Factors such as rising consumption and infrastructure investment play a key role in potential job creation. The relative level of jobs gained in healthcare relates closely to the changing proportion of the population aged over 65, especially in mature economies. This is due to the fact that as populations age, healthcare spending increases, and that sector is a major driver of job creation in mature economies. Given women's relatively high representation today in healthcare, we find that women could be somewhat better positioned than men to capture opportunities from jobs gained—the share of jobs gained could be higher for women than men in most countries and is concentrated especially in healthcare. One exception to this pattern could be in Germany, where job growth could be concentrated in manufacturing (a sector in which men significantly outnumber women). Another exception could be in India, where about 60 percent of women are concentrated in agriculture, a sector that is not expected to gain jobs, versus only 37 percent of men.

Net jobs. In mature economies, net job growth could be concentrated in only two sectors: PST and healthcare. Women are well represented in the second but less well represented in the first; women currently account for about 44 percent of all workers in PST in mature economies, which is lower than their 47 percent average share of overall

Exhibit E11

Summary of key measures: Overview of results (1/2).

	Per capita GDP, 2017, $ thousand PPP	% of population 65+		Female labor-force participation rate, %	Gender Concentration Index,[1] occupations, 0–100	Change in female share of employment, 2017–30, percentage points
		2017	2030			
Canada	47	17	23	61	47	1–2
France	43	20	24	50	47	0–1
Germany	51	21	27	55	47	-1–0
Japan	43	27	30	50	45	0–1
United Kingdom	43	19	22	57	49	0–1
United States	60	15	20	56	40	0–1
China	17	11	17	61	27	0–1
India	7	6	8	27	62	-1–0
Mexico	18	7	10	44	53	0–1
South Africa	13	5	7	48	45	1–2

[1] The index measures the concentration of people of both genders in sectors and occupations. The index was created by calculating the sum of the squares of the distance from equal gender representation in each sector or occupation within a country, and then taking the square root. The index was then adjusted to fit a zero-to-100 scale, with zero indicating equal representation and 100 indicating fully gendered occupations and sectors.

Note: Countries ordered based on mature and emerging economies, and alphabetically within each group.

Source: McKinsey Global Institute analysis

employment. In emerging economies, positive net job growth could occur in a broader range of sectors including manufacturing, accommodation and food services, retail and wholesale, and construction (for example, 74 percent of net jobs gained by women in India, 22 percent in China, and 75 percent in Mexico). We find that women tend to be more present than men in accommodation and food services and healthcare relative to their overall share of employment, and underrepresented in manufacturing.[1]

Transitions. On average, women face a comparable need to transition occupations relative to men. Globally, in a midpoint automation scenario, an average of 7 percent of women (40 million) could face a need to transition, compared with 8 percent of men (60 million). Men may face slightly higher rates of transition, particularly in mature economies, given larger displacement in sectors such as manufacturing. In India and Mexico, rates of transition are comparable. Under an early automation scenario, an average of 24 percent of women (160 million) and 28 percent of men (275 million) could face a need to transition globally. The gap between women and men widens in an early automation scenario due to a shift in occupational mix that is weighted more heavily toward occupations involving routine physical work where men are more highly represented, such as grounds maintenance workers, heavy-truck drivers, and farm laborers.[2]

[1] This analysis does not include wholly new occupations that do not exist today. Past research in the United States suggest that up to 9 percent of the employed population in 2030 could be working in entirely new occupations that could add 160 million or more jobs. Based upon analysis conducted in Jeffrey Lin, "Technological adaptation, cities, and new work," *Review of Economics and Statistics*, May 2011, Volume 93, Number 2.

[2] Occupations that have a high concentration of routine physical work activities exhibit the fastest acceleration in automation adoption rates between a midpoint and an early automation adoption scenario.

Exhibit E11 (Continued)

Summary of key measures: Overview of results (2/2).

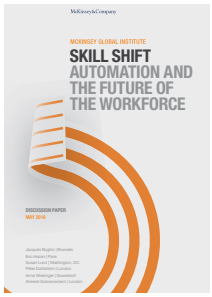
Women Men

	Potential jobs displaced by 2030		Potential jobs demanded in 2030		Job transitions	
	Million FTE	% of 2017 employment	Million FTE	% of 2017 employment	Million FTE	% of 2017 employment
Canada	2	24	2	24	1-3	8–30
	3	28	2	23	1-3	9–36
France	3	22	2	15	1-4	10–30
	3	23	2	16	2-5	11–33
Germany	4	21	4	23	1-5	6–24
	5	22	5	24	2-7	8–32
Japan	6	24	2	8	4-10	15–39
	9	24	3	6	7-17	17–43
United Kingdom	3	22	3	17	1-4	8–29
	4	24	3	17	2-5	10–33
United States	19	24	15	19	8-24	10–34
	20	26	14	18	9-28	10–33
China	52	15	112	33	4-36	1–10
	66	15	120	28	8-67	1–15
India	12	10	23	19	1-11	0–8
	44	12	91	24	2-27	0–7
Mexico	3	17	6	29	<1-3	2–12
	6	18	8	25	1-5	2–15
South Africa	1	18	1	13	1-2	9–26
	2	22	1	9	1-3	13–37

Note: These data are based upon a midpoint scenario of automation and a trend-line scenario of job creation.

Source: McKinsey Global Institute analysis

Related MGI and McKinsey research



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